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Response of different drip irrigation volumes and mulches on yield of fennel (*Foeniculum vulgare*) in western part of Rajasthan

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Abstract

A field experiment was conducted at Research Farm College of Agriculture, S.K. Rajasthan Agricultural University, Bikaner to evaluate the different drip irrigation volume and mulches on growth and yield of fennel. The experiment was carried out in split plot design with three replications. There were five treatment viz. drip at 1.0, 0.85, 0.70 and 0.55 and surface irrigation in main plots and mulches viz. organic mulch, polythene mulch and with out mulch were used in sub plots. The height of plant was maximum (130 cm) with 1.0 volume of drip than the other volume of drip and surface irrigation. When water volume of drip was decrease from 1.0 to 0.55 the plant height was similarly reduced and height was also recorded maximum with polythene mulch. The highest yield and water use efficiency was obtained under the 0.55 volume of drip (14.72q/h) however it was recorded minimum (8.62q/h) in surface irrigation. In mulches, yield and water use efficiency was recorded in Polythene mulches.

Key Words: Fennel, drip irrigation, mulch

Introduction

Fennel (*Foeniculum vulgare*) is a member of the Umbelliferae (Apiaceae) or carrot family. Fennel has a thick, spindle-shaped taproot that produces a pithy, smooth or finely-fluted round stem that may reach to 6 ft (1.8 m) in height. The seeds, leaves, and roots of fennel are safe and edible. Fennel has been widely used in culinary and medicinal preparations for centuries. The herb acts as a carminative, and was traditionally employed as a digestive aid and remedy for flatulence. An infusion or decoction of the dried seeds is anti-spasmodic and will ease stomach pains and speed up the digestion of fatty foods. Fennel is a proven remedy for colic in infants, and is safe when administered as a mild infusion of the leaf and seed. It is also used for coughs and colds. Fennel exerts a calming influence on the bronchial tissues. The seeds contain large amounts of the photochemical alpha-pinene, which acts as an expectorant and helps to loosen phlegm in the lungs. The herb is rich in potassium - an essential mineral which helps decrease the high blood pressure that can cause a heart attack. The major producer countries of this crop are India 110000, Mexico 49688 and China 40000 tones per year. In India it is mainly cultivated in Gujarat and Rajasthan (51.47 and 9.1 in thousand ha.) with production 84.20 and 14.88 thousand tones, respectively. Due to high medicinal use of this spice crop, the area should increase but due to adverse climatic conditions of Western Rajasthan .The area under this crop is negligible. However area and production both can increase if the modern irrigation techniques will involve in irrigating the cultivated area of this crop in arid part of Rajasthan. Under such circumstances micro irrigation, an approach for irrigation water management has played a most significant role to bring more area under increasing the productivity of crop and water use efficiency (Sivanappan, 2004) .Drip irrigation is one of the important and most efficient method of irrigation, which is becoming increasingly popular in areas of water scarcity. The response of fennel to irrigation in yield improvement was found to be different in different agro-climatic and soil conditions in India. Besides, in order to mitigate the adverse effect of water stress, efficient In-Situ moisture conservation is one of the common practices to reduce evaporation loss from the soil and prolong the moisture availability of water resulting in higher yield per unit of water applied. The use of mulches have found to conserve soil moisture ,control weeds, moderate soil temperature and increase in yield of different vegetable and spices crops (Singh and Kumar,2007). Therefore, more attention is required towards integration of drip irrigation and mulching to harness full advantage of improved efficiencies. Thus, a study was undertaken to evaluate the performance of Fennel with drip irrigation and mulch grown in hotarid climate of Rajasthan.

Materials and Methods

An experiment was conducted on fennel during the *Rabi* season of the year of 2006-07 at College of Agriculture, S.K. Rajasthan Agriculture University, Bikaner (28°01' N, 73°22'E and 234.7 m above mean see level).The climate of this zone is typical arid characterized

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by aridity of the atmosphere and deep, sandy and coarse loamy, saline desert soil with low water holding capacity and extreme of temperature both during summer and winter. The average rainfall of this tract is about 250mm. The soil of the field was loamy sand, low in organic carbon and nitrogen, medium in phosphorus and high in available potassium and had pH 8.2 ,electrical conductivity 0.2 ds/m with field capacity of 7.4% and permanent wilting point 5.0. The experiment was laid out in split plot design and replicated thrice with levels of irrigation viz. drip at 1.0, 0.85, 0.70 and 0.55 pan evaporation fraction and surface irrigation at 1.0 IW/CPE ratio as main plots. In sub plots; three mulching treatment viz., no mulch, organic mulch (*Aerva persica*) and polyethylene (25micron) were applied after germination of plant. The volume of water required under drip irrigation system was computed using the equation V=Ep x Kp x Kc x A x Wp. Where , V-volume of water required in liter/day, Ep-Mean pan evaporation for the month in mm/day, Kp-Pan coefficient (0.7for class A pan), Kc-Crop coefficient , A-plant to plant x row to row spacing (0.4 x 0.4 m) , Wp-Wetting fraction (0.9).The seed were sown at 40 x 40 cm row to row and plant to plant spacing. Seed was sown in field in 1st week of October. In drip irrigation water was applied alternatively on the basis of equation, while in surface method water was applied at weekly interval. FYM (150q/h) was applied at the time of field preparation. A required dose of fertilizer 100 kg N and 50kg P_2O_5 were applied in the form of urea and DAP. Half dose of N and full dose P was applied at the time of seed sowing and remaining dosse of nitrogen were applied with irrigation water. Harvesting is done by cutting the umbels as and when they reach to physiological maturity (when seeds are fully filled up & green in colour). After cutting the umbels they are dried in partial shade. The observations on various yield attributes and yield were recorded as per standard procedures. All the data generated were subject to analysis of variance and least significant difference (LSD) at 5 % probability level was obtained.

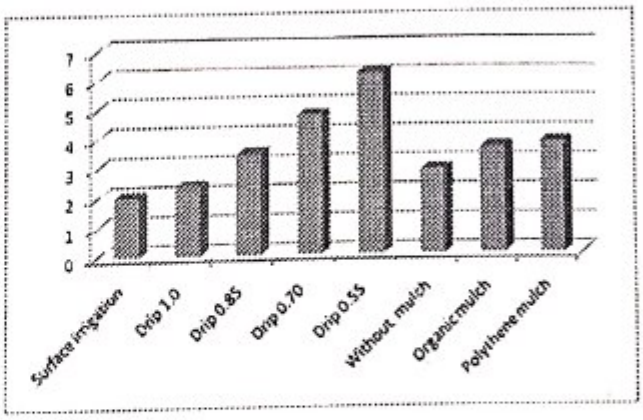
Results and Discussion

The results of experiment revealed that the treatment of water volume and mulches significantly influenced the growth, yield nutrient content of fennel. The height of plant was significantly maximum (130 cm) with 1.0 volume of drip than the other volume of drip and surface irrigation. When water volume of drip was decrease from 1.0 to 0.55 the plant height was similarly reduced. It is well known fact that sufficient moisture for progressive plant growth is maintain by drip irrigation which, tends to better development of photosynthetic area and accelerate photosynthetic rate. Thus, as a consequence, plant growth is accelerated. High frequency of water application by drip irrigation minimizes soil moisture losses, provides at least daily requirements of water to a portion of the root zone of each plant, and maintains high soil water metric potential in the rhizosphere to reduce plant water stress (Tiwari et.al. 1988, Singh and Rajput 2007) . Amongst the mulches treatment, the maximum height (116.95 cm) was observed under the polythene mulch than the organic mulch (112.14 cm) and without mulch (104.12 cm). The height of plant was higher mainly due to more availability of water in both treatments. The Number of branches /plant was significantly increased with decreasing the water volume up to 0.70 after that the branches were decreased with 0.55 volume of drip but there was not observed any significant difference between 0.70(13.74) and 0.55 volume of water(13.38). Further, more number of branches was observed under polythene mulch (13.98) and it was 9.34 under without mulch .It is oblivious that mulching leads to better plat growth by changing micro-climate by conserving more moisture through reduced evaporation , modifying soil temperature ,controlling weeds and thus economizing the use of irrigation water (Yadav,2005). Chlorophyll content at 70 DAS was recorded maximum (1.85 mg/g) in treatment 0.70 volume of drip and it was noticed minimum in surface irrigation (1.46 mg/g) it might be higher due to appropriate of plant growth under drip treatments. In mulches, both organic and polythene mulch recorded higher chlorophyll content over without mulch (1.63 mg/g).

The yield and yield parameters were observed significantly higher under drip irrigation and mulches over surface irrigation and with out mulches. The highest yield was recorded under the 0.55 volume of drip (14.72q/h) however it was recorded minimum (8.62q/h) in surface irrigation. It is a high irrigation efficiency of drip irrigation method which can fulfill the requirement of plants with comparatively less application of water providing over excessive vegetative growth during crop development stage .The yield was increased by increased the umbels per plant .This was also due to better utilization of water and easy uptake of nutrient by plant and excellent soil air water relationship with higher oxygen concentration in the root zone (Gornat et.al,1973,Jadhav et.al, 1990 and Sivanappam ,1992). Singh and Kumar (2007) reported that it may also be due to the optimum moisture condition in the entire root zone of the crop which reflects in better physiological activities of plants. Among mulches, polythene mulch was received maximum yield (13.35q/h) than the without mulch (10.09q/h).The higher yield under black plastic mulch may be ascribed to reduced nutrients losses due to weed control and improved hydrothermal regimes of soil over control(Saikia,etal,1997).

Nitrogen and phosphorus content were received highest with application of drip treatment over surface irrigation. The nitrogen and phosphorus content 1.75 % and 0.31%) were recorded maximum, respectively with the application 0.55 volume of drip might be attributed to adequate and balanced supply of nutrient. It well established fact that nutrient uptake by the crop depend primarily on dry matter accumulation and secondary

nutrient concentration at cellular level. The increased photosynthetic efficiency resulting in more dry matter accumulation might be the major factor responsible for higher N and P content in plant under the application of 0.55 volume of drip .Similar results were respectively by Bacchane and Sabale 1996, Thanunathan etal., 2002 and Das et.al, 2002.Mulches treatment were also influenced the both nitrogen and phosphorus content in plant, the maximum value were received 1.71and 0.28 %, respectively under polythene mulch and it were minimum with out mulch. The maximum water use efficiency (6.18 q/h-cm) was recorded with 0.55 volume of drip. It is due to the fact that at this volume of drip, the yield was maximum and water used was relatively less (306.06 mm). Bisides, 0.55 volume of drip checked excessive vegetative growth. However, water use efficiency declined with successive increase in irrigation levels due to greater expense of water by evapo-traspiration as a result vegetative growth without proportion increase in yield (Saikia etal., 1997,; Yadav,etal., 2007 and Singh and Kumar 2007).



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